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NASTRAN LEVEL 16 PROGRAMMER'S MANUAL UPDATES FOR AEROELASTIC ANALYSIS OF BLADED DISCS

by

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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONTRACT NAS3-20382

NASA LEWIS RESEARCH CENTER
CLEVELAND, OHIO

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INTRODUCTION

A computer program based on state-of-the-art compressor and structural technologies applied to bladed shrouded discs has been developed and made operational in NASTRAN Level 16.

The problems encompassed include aeroelastic analyses, modes and flutter.

The program is documented in the form of five NASA Contractor's Reports —— one Technical Report and four Updates to NASTRAN Level 16 Theoretical, User's, Programmer's and Demonstration manuals. This report describes the Programmer's manual updates.

PROGRAMMER'S MANUAL UPDATES

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DATA BLOCK AND TABLE DESCRIPTIONS

2.2.2 Index for Data Block Descriptions Sorted Alphabetically by Module

Card Type Formats Cont'd.:

BDYS (Open Ended)	SID	G1	G1
	G2	C2	...
	...	-1	-1
BDYS1 (Open Ended)	SID	C	G1
	G2	...	-1
CØNCT (Open Ended)	SID	C	SUBA
	SUBB	GA	GB
	GA	GB	...
	...	-1	-1
CØNCT1 (Open Ended)	NSUB	SID	NAME1
	...	$NAME_{NSUB}$	C1
	G11	...	$G_{1,NSUB}$
	C2	G21	...
	$G_{2,NSUB}$	...	-1
CRIGD1 (Open Ended) and CRIGD2 (Open Ended)	EID	IG	G1
	G11	G12	G13
	G14	G15	G16
	G2	G21	G22
	G23	G24	G25
	G26	...	GM
	GM1	GM2	GM3
	GM4	GM5	GM6
	-1	N	-1
	-1	-1	-1
	-1		
CSP (open ended)	SID	GA1	GB1
	GA2	GB2	...
	...	GAn	GBn
	-1	-1	
CYJØIN (Open Ended)	SIDE	C	G1
	G2	...	-1
GNEW (5 words)	SID	NAME	C
	GID	GIDØ	
GTRAN (4 words)	TID	NAME	GID
	TRAN		
LØADC (Open Ended)	SID	S	NAME1
	NAME2	S1	S1
	...	...	...
	...	(blank)	(blank)
	-1	-1	
MPC (Open Ended)	SID	G	C
	A	G	C
	A	...	G
	C	A	-1
	-1	-1	
MPCADD (Open Ended)	SID	S1	S2
	...	S_n	-1
MPCAX (Open Ended)	SID	RID	C
	V	...	...
	...	-1	-1
	-1		

See Section 4.6.2 for additional information.

2.3.86 Data Blocks Output from Module ALG

2.3.86.1 CASECCA (Table)

Description

See description and format of CASECC table - Section 2.3.1.1.

2.3.86.2 GEOM3A (Table)

Description

See description and format of GEOM3 table - Section 2.3.2.3.

2.3.87 Data Blocks Output from Module APDB

2.3.87.1 AERØ (Table)

Description

See description and format of AERØ table - Section 2.3.62.8.

2.3.87.2 FLIST (Table)

Description

See description and format of FLIST table - Section 2.3.62.11.

2.3.87.3 GTKA (Matrix)

Description

See description and format of GTKA matrix - Section 2.3.63.1.

2.3.87.4 PVECT (Matrix)

Description

{ PVECT } - Partitioning vector for cyclic modes.

Matrix Trailer

Number of columns = 1
Number of rows = NEIGV (for KINDEX > 0, 2 · NEIGV)
Form = rectagular
Type = real-single precision

2.3.87.5 ACPT (Table)

Description

Aerodynamic connection and property table for compressor blades. Contains one record for each compressor blade.

Table Format

Record	Word	Type	Item
0	1-2	B	Data block name (ACPT)
1	1	I	Key word, 6 for compressor blades
	2	I	IREF parameter
	3	R	MINMACH parameter
	4	R	MAXMACH parameter
	5	I	Number of blade streamlines, NLINES
	6	I	Number of stations on blade, NSTNS
	7	I	Streamline number, SLN
	8	I	Number of stations on streamline, NSTNSX
	9	R	Stagger angle, STAGGER
	10	R	Chord length, CHORD
	11	R	Radius of streamline, RADIUS
	12	R	Blade spacing, BSPACE
	13	R	Mach number, MACH
	14	R	Gas density, DEN
	15	R	Flow velocity, VEL
	16	R	Flow angle, FLOWA
	17	R	X-coordinate, basic
	18	R	Y-coordinate, basic
	19	R	Z-coordinate, basic
2			Additional records for other blade

Table Trailer

Word 1 = 1
Word 2-6 = zero

Notes

1. Words 7-19 are repeated for each streamline. There are NLINES streamlines and they are from the blade root to the blade tip. These data items are taken from the STREAML2 bulk data cards.

2. Words 17-19 are repeated for each node on the streamline. There are NSTNS triplets (X, Y, Z). They are from the blade leading edge to the blade trailing edge.

MODULE PROPERTIES LIST

MPL ID	NWDS	WD1	MOD-NAME	TYP	IN	OUT	SCP	TOT	PARAMETERS ID	TYP	P	DEFAULT (IF ANY)	W1-W2 FLG
162	15	2242	EQMCK	1	12	1	7	20					
									1.	INT	2249	0	1
									2.	INT	2251	-1	2
									3.	INT	2253	-- NO DEFAULT --	3
									4.	BCD	2254	NONE	4- 5
163	29	2257	ALG	1	7	2	4	13					
									1.	INT	2264	-1	1
									2.	INT	2266	-1	2
									3.	INT	2268	-1	3
									4.	INT	2270	-1	4
									5.	INT	2272	0	5
									6.	INT	2274	0	6
									7.	RSP	2276	1.0000E 00	7
									8.	RSP	2278	0.0	8
									9.	RSP	2280	1.0000E 00	9
									10.	RSP	2282	1.0000E 00	10
									11.	RSP	2284	1.0000E 00	11
164	7	2286	CSA	1	4	1	1	6	----- NO PARAMETERS EXIST -----				
165	20	2293	APDB	1	7	5	5	17					
									1.	INT	2300	-- NO DEFAULT --	1
									2.	INT	2301	-- NO DEFAULT --	2
									3.	RSP	2302	1.0100E 00	3
									4.	RSP	2304	8.0000E-01	4
									5.	INT	2306	-1	5
									6.	BCD	2308	COSINE	6- 7
									7.	INT	2311	-- NO DEFAULT --	8
									8.	INT	2312	-- NO DEFAULT --	9

MODULE PROPERTIES LIST

MPL ID	NWDS	WD1	MOD-NAME	TYP	IN	OUT	SCR	TOT	PARAMETERS			
									ID	TYP	P	DEFAULT (IF ANY)

W1-W2 FLG

*** END OF MPL PRINTOUT

*** THE MPL CONTAINS 165 ENTRYS. OF THESE, 0 ARE PAD ENTRYS.

MODULE INDEX	DMAP NAME OF MODULE	MODULE ENTRY POINT NAME	LINKS MODULE RESIDES IN ON 360													
154	SUBPH1	SUBPH1													15	
155	PLTMRG	PLTMRG													15	
156	COPY	COPY					7									
157	SWITCH	SWITCH					7									
158	MPY3	MPY3					7									
159	SDCMPS	SDCMPS													15	
160	LODAPP	LODAPP													15	
161	GPSPC	GPSPC		4												
162	EQMCK	EQMCK												14		
163	ALG	UD0300				6										
164	CSA	CSA				6										
165	APDB	APDB						9								

4.1.2 Alphabetical Index of Module Functional Descriptions

Section Number	Module Name	Section Number	Module Name
4.78	ADD	4.32	GPSP
4.96	ADD5	4.29	GPWG
4.149	ALG	4.21	GP1
4.114	AMG	4.22	GP2
4.115	AMP	4.25	GP3
4.112	APD	4.31	GP4
4.150	APDB		
4.217	ASDMAP		
***	BEGIN	4.5	IFP*
4.90	BMG	4.3	IFP1
4.56	CASE	4.6	IFP3*
4.59	CEAD	4.89	IFP4*
4.10	CHKPNT	4.91	IFP5*
4.128	CØMB1	4.97	INPUT
4.129	CØMB2	4.98	INPUTT1
4.13	CØND	4.99	INPUTT2
4.148	CØPY	**	INPUTT3
4.110	CYCT1	**	INPUTT4
4.111	CYCT2	4.12	JUMP
**	DDR	**	LABEL
4.141	DDRMM	4.72	MATGPR
4.67	DDR1	4.71	MATPRN
4.68	DDR2	4.73	MATPRT
4.81	DECØMP	4.33	MCE1
4.143	DIAGØNAL	4.34	MCE2
4.47	DPD	4.84	MERGE
4.121	DSCHK	**	MØDA
4.49	DSMG1	4.126	MØDACC
4.51	DSMG2	**	MØDB
**	DUMMØD1	**	MØDC
**	DUMMØD2	4.79	MPYAD
**	DUMMØD3	4.57	MTRXIN
**	DUMMØD4	4.70	ØFP
4.123	EMA	4.120	ØPTPR1
4.124	EMG	4.142	ØPTPR2
4.18	END	**	ØUTPUT
4.17	EQUIV	4.100	ØUTPUT1
4.130	EXIØ	4.101	ØUTPUT2
4.14	EXIT	4.102	ØUTPUT3
4.116	FA1	**	ØUTPUT4
4.117	FA2	4.19	PARAM
4.82	FBS	4.118	PARAML
***	FILE	4.119	PARAMR
4.61	FRRD	4.83	PARTN
4.113	GI	**	PARTVEC
4.58	GKAD	4.52	PLA1
4.66	GKAM	4.53	PLA2
4.109	GPCYC	4.54	PLA3
4.146	GPFDR	4.55	PLA4
		4.24	PLØT

* Executive System Internal Module, ** Dummy Module,
*** Executive System Instruction (No Module Functional Descriptions)

4.1.3 Alphabetical Index of Entry Points in Module Functional Descriptions

MODULE FUNCTIONAL DESCRIPTIONS

Section Number	Entry Point	Module Name	Page Number
4.128.8.5	BDAT02	CØMB1	4.128-12
4.128.8.8	BDAT03	CØMB1	4.128-14
4.128.8.10	BDAT04	CØMB1	4.128-20
4.128.8.6	BDAT05	CØMB1	4.128-12
4.128.8.7	BDAT06	CØMB1	4.128-13

Table 1(g). Bulk Data Cards Processed by IFP Sorted by Internal Card Number.

A	B	C	D	E	F	G	H	I	J	K	L	M	N	Ø IJHK
233	QHBDY	9	GEØM3	0	9	9	901	0	4309	43	S1	5050	-1	32D5
234	MAT4	3	MPT	0	4	8	198	1	2103	21	S1	3900	-1	32D6
235	MAT5	3	MPT	0	4	8	198	1	2203	22	S1	4000	-1	32E1
236	PHBDY	2	EPT	0	4	8	350	1	2502	25	S1	5100	-1	32E2
237	MATT4	3	MPT	0	4	8	37	1	2303	23	S1	3950	-1	32E3
238	MATT5	3	MPT	0	4	8	37	1	2403	24	S1	4050	-1	32E4
239	QBDY1	9	GEØM3	0	-4	9	774	0	4509	45	S4	1990	-1	32E5
240	QBDY2	9	GEØM3	0	4	8	350	0	4909	49	S1	5150	-1	32E6
241	QVECT	9	GEØM3	0	-4	16	-1	0	5009	50	S1	5200	-1	33A1
242	QVØL	9	GEØM3	0	-4	9	774	0	5209	52	S1	1990	-1	33A2
243	RADLST	14	MATPØØL	0	-4	16	-1	0	2014	20	S1	5250	-1	33A3
244	RADMTX	14	MATPØØL	0	-4	8	-1	0	3014	30	S3	1400	-1	33A4
245	SAME	10	GEØM4	0	-4	10	-1	0	7810	78	S5	4600	-1	33A5
246	SAME1	10	GEØM4	0	-8	9	-1	0	7910	79	S5	5	-1	33A6
247	INPUT	11	GEØM5	0	17	17	-1	0	1310	13	S5	5	-1	33B1
248	ØUTPUT	11	GEØM5	0	17	17	-1	0	1410	14	S5	5	-1	33B2
249	CQDMEM1	8	GEØM2	0	8	12	325	0	2008	20	S1	3460	-1	33B3
250	PQDMEM1	2	EPT	0	4	8	237	0	2202	22	S1	3000	-1	33B4
251	CIHEX1	8	GEØM2	0	12	16	951	1	7108	71	S5	5000	-1	33B5
252	CIHEX2	8	GEØM2	0	24	28	951	1	7208	72	S5	5100	-1	33B6
253	CIHEX3	8	GEØM2	0	36	40	951	1	7308	73	S5	5200	-1	33C1
254	PIHEX	2	EPT	0	4	12	981	1	7002	70	S5	5300	-1	33C2
255	PLØAD3	9	GEØM3	0	8	12	949	0	7109	71	S5	5400	-1	33C3
256	SPCD	10	GEØM4	0	4	8	101	0	5110	51	S1	1600	-1	33C4
257	CYJØIN	10	GEØM4	0	-4	16	-1	0	5210	52	S1	5240	-1	33C5
258	CNGRNT	8	GEØM2	0	-4	16	-1	0	5008	50	S1	5245	-1	33C6
259	CQDMEM2	8	GEØM2	0	8	12	325	0	5308	53	S1	3460	-1	33D1
260	PQDMEM2	2	EPT	0	4	8	237	0	5302	53	S1	3000	-1	33D2
261	CQDMEM3	8	GEØM2	0	8	12	325	0	5408	54	S1	3460	-1	33D3
262	PQDMEM3	2	EPT	0	4	8	237	0	5402	54	S1	3000	-1	33D4
263	CAERO1	4	EDT	0	16	16	39	1	3002	30	S5	6400	-1	33D5
264	PAERO1	4	EDT	0	4	8	803	1	3102	31	S5	6500	-1	33D6
265	AERØ	4	EDT	0	8	12	2	0	3202	32	S5	6600	-1	33E1
266	SPLINE1	4	EDT	0	8	12	42	1	3302	33	S5	6700	-1	33E2
267	SPLINE2	4	EDT	0	12	16	1025	1	3402	34	S5	6800	-1	33E3
268	SET1	4	EDT	0	-4	16	-1	0	3502	35	S1	5300	-1	33E4
269	SET2	4	EDT	0	4	8	197	0	3602	36	S5	5600	-1	33E5
270	MKAERO2	4	EDT	0	4	8	805	0	3702	37	S5	5700	-1	33E6
271	MKAERO1	4	EDT	0	16	16	805	0	3802	38	S5	5800	-1	41A1
272	FLUTTER	4	EDT	0	10	14	1005	1	3902	39	S5	5900	-1	41A2
273	AEFACT	4	EDT	0	-4	16	-1	1	4002	40	S3	1415	-1	41A3
274	FLFACT	4	EDT	0	-4	16	-1	1	4102	41	S3	1415	-1	41A4
275	CBARAO	8	GEØM2	0	9	13	-1	1	4001	40	S5	6100	-1	41A5
276	PLINIT	3	MPT	0	-9	14	-1	0	304	3	S5	6200	-1	41A6
277	PØPT	3	MPT	0	9	13	1017	0	404	4	S5	6300	-1	41B1
278	PLØADX	9	GEØM3	0	8	12	1037	0	7001	70	S5	6900	-1	41B2
279	CRIGD1	10	GEØM4	-2	-4	48	-1	1	5310	53	S3	2010	-1	41B3
280	CQUADTS	8	GEØM2	0	8	20	1045	1	4108	41	S4	2020	-1	41B4
281	PQUADTS	2	EPT	0	8	12	277	1	2402	24	S4	2030	-1	41B5
282	CTRIATS	8	GEØM2	0	8	20	1047	1	5908	59	S4	2021	-1	41B6
283	PTRIATS	2	EPT	0	8	12	277	1	2302	23	S4	2030	-1	41C1
284	CRIGD2	10	GEØM4	-2	-6	48	-1	1	5410	54	S3	2060	-1	41C2
285	CTRIAAX	15	AXIC	-2	4	8	313	1	7012	70	S3	2111	0	41C3
286	PTRIAAX	2	EPT	-2	4	24	349	1	7032	85	S3	2030	0	41C4
287	CTRAPAX	15	AXIC	-2	4	8	325	1	7042	74	S3	2040	0	41C5
288	PTRAPAX	2	EPT	-2	4	24	349	1	7052	95	S3	2030	0	41C6
289	VIEW	2	EPT	0	4	8	326	1	2606	26	S1	5175	0	41D1
290	VARIAN	4	EDT	0	-4	16	-1	0	4202	42	S3	1410	0	41D2
291	CSP	10	GEOM4	0	-4	8	-1	0	3291	91	S3	2910	-1	4103
292	STREAML1	4	EDT	0	-4	9	-1	1	3292	92	S3	2920	-1	4104
293	STREAML2	4	EDT	0	12	16	45	1	3293	93	S3	3010	-1	4105

Each combination has four influence quadrants (upper left, upper right, lower left, lower right), so these routines must be called four times for each element and then the result summed before SUBP returns. Subroutine INCRØ uses subroutines TKER, IDF1, and IDF2 to compute the final result.

The flow for Section two of the Doublet Lattice method is as follows. Subroutine DLPT2 prepares all the computations necessary. DLPT2 reads the record of ACPT and then loops through each box packing out a column of SKJ, D1JK, and D2JK for each box.

The row position of each pair of values for a column is 2*(box number-1) + 1. Successive rows of SKJ have the following form:

$$SKJ \rightarrow \left[\frac{2.0 * EE_{strip} * DELX_{box}}{EE_{strip} * DELX_{box}^2/2.0} \right] \quad (1)$$

Successive rows of D1JK have the following form:

$$D1JK \rightarrow \left[\frac{0.0}{1.0} \right] \quad (2)$$

Successive rows of D2JK have the following form:

$$D2JK \rightarrow \left[\frac{-2.0/REFC}{DELX_{box}/2.0*REFL} \right] \quad (3)$$

4.114.7.2 Compressor Blade Method

The flow for Section one of the compressor blade method is as follows. Subroutine AMGB1 is the driver for this method. It reads in the ACPT record for this method and locates reference parameters from the reference streamline on the

blade. If there is enough core available, it calls AMGB1A to output one matrix of the AJJL list. When AMGB1A is through, AMGB1 bumps NRØW and returns.

Subroutine AMGB1A outputs a portion of the AJJL matrix for each streamline on the compressor blade. Each streamline may be subsonic, transonic or supersonic, depending on the Mach number for that streamline. Subroutine AMGB1B calculates terms for subsonic streamlines. Subroutine AMGB1C calculates terms for supersonic streamlines and subroutine AMGB1D calculates terms for transonic streamlines.

Each submatrix of AJJL corresponds to a blade streamline and is of order NSTNS X NSTNS, where NSTNS is the number of computing stations on the blade. The submatrices are located along the diagonal of AJJL. AJJL transpose is output.

The flow for Section two of the compressor blade method is as follows. Subroutine AMGB2 prepares all the computations necessary. It reads the ACPT record and locates the reference streamline parameters. Subroutine AMGB2A is called to calculate the W factor and matrix $[F^{-1}]$ for each streamline. AMGB2 outputs the NSTNS X NSTNS submatrix for each streamline to the [SKJ] and [D1JK] matrices. Each submatrix of [SKJ] and [D1JK] has the following form:

$$[SKJ] = W \cdot [F^{-1}]^T$$

and

$$[D1JK] = [F^{-1}]^T$$

The [D2JK] matrix is null.

4.114.8 Subroutines

Besides the module driver AMG, the subroutines are divided into groups by method.

For the Doublet Lattice method the subroutines are:

DLAMG, GEND, DPPS, SUBP, SNPDF, INCRØ, IKER, IDF1, IDF2, and DLPT2.

FUNCTIONAL MODULE AMG (AERODYNAMIC MATRIX GENERATOR)

4.114.8.1 Subroutine Name: AMG

1. Entry Point: AMG

2. Purpose: Module driver for AMG - see description above.

3. Calling Sequence: CALL AMG

DIIJR = output - real part of nonplanar integral contribution

DIIJI = output - imaginary part of nonplanar integral contribution

4.114.8.11 Subroutine Name: DLPT2

1. Entry Point: DLPT2

2. Purpose: To output the Doublet Lattice parts for matrices SKJ, D1JK, and D2JK.

3. Calling Sequence: CALL DLPT2 (INPUT, SKJ, W1JK, W2JK)

INPUT = GINØ number for ACPT

SKJ = GINØ number for SKJ

W1JK = GINØ number for D1JK

W2JK = GINØ number for D2JK

4.114.8.12 Subroutine Name: AMGB1

1. Entry Point: AMGB1

2. Purpose: Driver for the compressor blade method.

3. Calling Sequence: CALL AMGB1 (INPUT, MATØUT)

INPUT = GINØ file number for ACPT

MATØUT = GINØ file number for AJJL

4.114.8.13 Subroutine Name: AMGB1A

1. Entry Point: AMGB1A

2. Purpose: Output all the columns of AJJL associated with a record of ACPT.

3. Calling Sequence: CALL AMGB1A (INPUT, MATØUT, AJJ, AJJT, TØØNX, TAMACH, TREFD)

INPUT = GINØ file number of ACPT
MATØUT = GINØ file number of AJJL
AJJ = Storage for AJJL submatrices - complex
AJJT = Storage for one column of AJJL
TØØNX = Stores position of transonic submatrix in AJJL for a particular transonic streamline
TAMACH = Stores Mach numbers of transonic streamlines
TREFD = Stores reduced frequencies of transonic streamlines

4.114.8.14 Subroutine Name: AMGB1B

1. Entry Point: AMGB1B

2. Purpose: Calculates AJJL terms for subsonic streamlines.

3. Calling Sequence: CALL AMGB1B (AJJL)

AJJL = Location to put subsonic AJJL submatrix for this streamline

4.114.8.15 Subroutine Name: AMGB1C

1. Entry Point: AMGB1C

2. Purpose: Calculates AJJL terms for supersonic streamlines.

3. Calling Sequence: CALL AMGB1C (AJJL)

AJJL = Location to put supersonic AJJL submatrix for this streamline

4.114.8.16 Subroutine Name: AMGB1D

1. Entry Point: AMGB1D

2. Purpose: Calculates AJJL terms for transonic streamlines.

3. Calling Sequence: CALL AMGB1D (AJJL, TØNX, TAMACH, TREDF)

AJJL = AJJL submatrices for all subsonic and supersonic streamlines. It also contains space for transonic submatrices.

TØNX = (integer) - vector - non-zero indicates transonic streamline zero if known streamline

TAMACH = Vector of streamline Mach numbers

TREDF = Vector of streamline reduced frequencies

4.114.8.17 Subroutine Name: INTERT

1. Entry Point: INTERT

2. Purpose: To linearly interpolate by Mach number a transonic general Air Force matrix given two known streamline matrices.

3. Calling Sequence: CALL INTERT (NL, NL1, NL2, NM, AJJ, TA)

NL = Streamline number of unknown transonic

NL1, NL2 = Two known streamlines

NM = Size of matrix in AJJ = 2 * NSTNS * NSTNS

AJJ = Contains all generalized Air Force matrices for all streamlines

TA = Vector of streamline Mach numbers

4.114.8.18 Subroutine Names: SUBA, SUBB, SUBC, SUBD, ALAMDA, AKP2, AKAPPA, DLKAPM, ASYCON, AKAPM, DRKAPM

1. Entry Points: The same as name

2. Purpose: Called by AMGB1C

4.114.8.19 Subroutine Name: GAUSS

1. Entry Point: GAUSS

2. Purpose: Equation Solver used by AMGB1B.

3. Calling Sequence: CALL GAUSS (A, N, NL)

4.114.8.20 Subroutine Name: AMGB2

1. Entry Point: AMGB2

2. Purpose: To output the compressor blade parts for matrices SKJ, D1JK, and D2JK.

3. Calling Sequence: CALL AMGB2 (INPUT, SKJ, W1JK, W2JK)

INPUT = GINØ file number for ACTP
SKJ = GINØ file number for SKJ
W1JK = GINØ file number for D1JK
W2JK = GINØ file number for D2JK

4.114.8.21 Subroutine Name: AMGB2A

1. Entry Point: AMGB2A

2. Purpose: Calculate $[F^{-1}]$ matrix and W factor used in the generation of SKJ and D1JK.

3. Calling Sequence: CALL AMGB2A (INPUT, FMAT, XYZB, INDEX, RADII, WFACT, NLINE)

INPUT = GINØ file number of ACPT
FMAT = Location for $[F^{-1}]$ matrix
XYZB = Location for basic coordinates of nodes on streamline
INDEX = Work storage for INVERS
WFACT = Factor for output

NLINE = Number of streamlines

RADII = Streamline radius

4.114.9 Design Requirements

For Section one, three buffers are allocated at the bottom of core. For Section two, four buffers are allocated at the bottom of core. Each method may have its own open core common block but they must not overlap these buffers.

4.114.9.1 Communication Common Blocks

AMGMN

Words			
1-7	MCB	- Trailer for AJJL	
8	NRØW	- Last row number output for any method on AJJL	
9	ND	- Y - symmetry flag	
10	NE	- Z - symmetry flag	1 record of AERØ
11	REFC	- Reference chord	
12	FMACH	- Mach number	Pairs from 2 record of AERØ
13	REK	- Reduced frequency	

4.114.9.3 Common Blocks for Compressor Blade Method

/BAMG1L/ and /BAMG2L/

Words:

1	IREF	- Reference streamline number
2	MINMAC	- Parameter MINMACH
3	MAXMAC	- Parameter MAXMACH
4	NLINES	- Number of streamlines on blade
5	NSTNS	- Number of stations on blade
6	REFSTG	- Reference blade stagger angle
7	REFCRD	- Reference blade chord
8	REFMAC	- Reference Mach number
9	REFDEN	- Reference density
10	REFVEL	- Reference velocity
11	REFFLØ	- Reference flow angle
12	SLN	- Streamline number
13	NSTNSX	- Number of stations on streamline
14	STAGER	- Blade stagger angle
15	CHØRD	- Blade chord
16	RADIUS	- Radius of streamline
17	BSPACE	- Blade spacing
18	MACH	- Relative flow Mach number at blade leading edge
19	DEN	- Gas density at blade leading edge
20	VEL	- Relative flow velocuty at blade leading edge
21	FLØWA	- Relative flow angle at blade leading edge
22	AMACH	- Internal Mach number
23	REDF	- Internal reduced frequency
24	BLSPC	- Internal blade spacing
25	AMACHR	- Internal reference Mach number
26	TSØNIC	- Transonic indicator

4.115.7.3 Subroutine AMPC

Calculate (or find) Q_{jh} if it is needed. It will be needed if either (a) Q_{jh} is to be output, or (b) Q_{hh} is to be output and is not found on the scratch file. The Q_{jh} and Q_{hh} are not to be output only when their output data blocks are purged. If Q_{jh} can be found on a scratch file, get it from there; otherwise, it must be calculated. First, check to see if $D_{jh}(k)$ has been calculated for the present k. If not, find it by

$$[D_{jh}] = [D_{jh}^{(1)}] + i\,k\,[D_{jh}^{(2)}] \quad , \tag{6}$$

and save for possible later use. Next, solve for Q_{jh}. The algebra included here will be theory dependent. The header record of AJJL will specify aerodynamic groups (see Section 4.115.7.5). Retrieve the submatrix $[A_{jj}]$ from AJJL and transpose it. If there is more than one group, D_{jh} must be unpacked into row groups. For each group, solve for $[Q_{jh}]$, then pack the groups. For Doublet Lattice method,

$$[Q_{jh}]_{group} = [A_{jj}^T]^{-1}_{group}\,[D_{jh}]_{group} \quad . \tag{7}$$

For the compressor blade method, retrieve the submatrix $[A_{jj}]$ from AJJL and compute

$$[Q_{jh}] = [A_{jj}^T]^T\,[D_{jh}] \quad .$$

There are no groups for the compressor blade method.

For other methods (including Doublet Lattice with bodies), the algebra will be specified at a later time, and the code will have to be added to the module.

4.115.7.4 Subroutine AMPD

Calculate (or find) $[Q_{hh}]$ if it is needed. It will be needed unless the output data block is purged. If $[Q_{hh}]$ can be found on a scratch file, get it there; otherwise, it must be calculated. If it must be calculated $[Q_{jh}]$ will be available. To compute $[Q_{hh}]$

$$[Q_{kh}] = [S_{kj}][Q_{jh}] \quad , \tag{8}$$

$$[Q_{ih}] = [G_{ki}]^T[Q_{kh}] \quad , \tag{9}$$

$$[Q_{hh}] = \text{Merge}\left[\frac{Q_{ih}}{Q_{eh}}\right] \quad , \tag{10}$$

where $[Q_{eh}]$ is zero. Note that this requires only an update of $[Q_{in}]$'s trailer.

Check the time. If $[Q_{jh}]$ and $[Q_{hh}]$ were calculated (rather than found), then the time per calculation can be found. If the time per calculation is known and it is not enough (with a 10% margin), no more loops should be attempted.

4.115.8 Subroutines

Numerous utility subroutines are used by the functional phases as shown below.

AMPA	AMPB	AMPC	AMPD
CYCT2B	CALCV	CYCT2B	CYCT2B
	SSG2B	SSG2C	SSG2B
	MERGED	CFACTR	
	PARTN	CFBSØR	
		FILSWI	
		TRANP1	
		SSG2B	

4.115.8.1 Subroutine Name: AMPA

1. Entry Point: AMPA

2. Purpose: To provide a scenario for later phases and to prepare for use of the appended output files.

3. Calling Sequence: CALL AMPA (AERØ, QJHL, QHHL, AJJL, QHHLØ, QJHLØ, INDEX, IMAX, IANY)

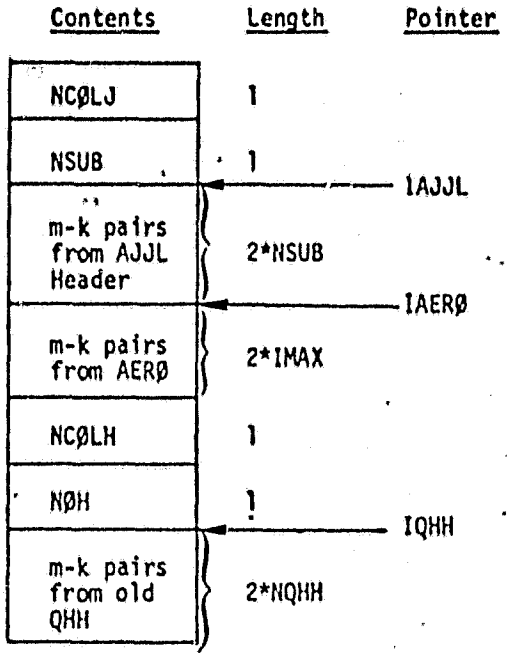
AERØ, QJHL, QHHL, and AJJL are the GINØ file numbers of their respective data blocks.

QHHLØ and QJHLØ are the GINØ file numbers of two scratch files to hold valid submatrices from QHHL and QJHL on restart.

INDEX is the GINØ file number of the scenario data block. Its contents are as follows:

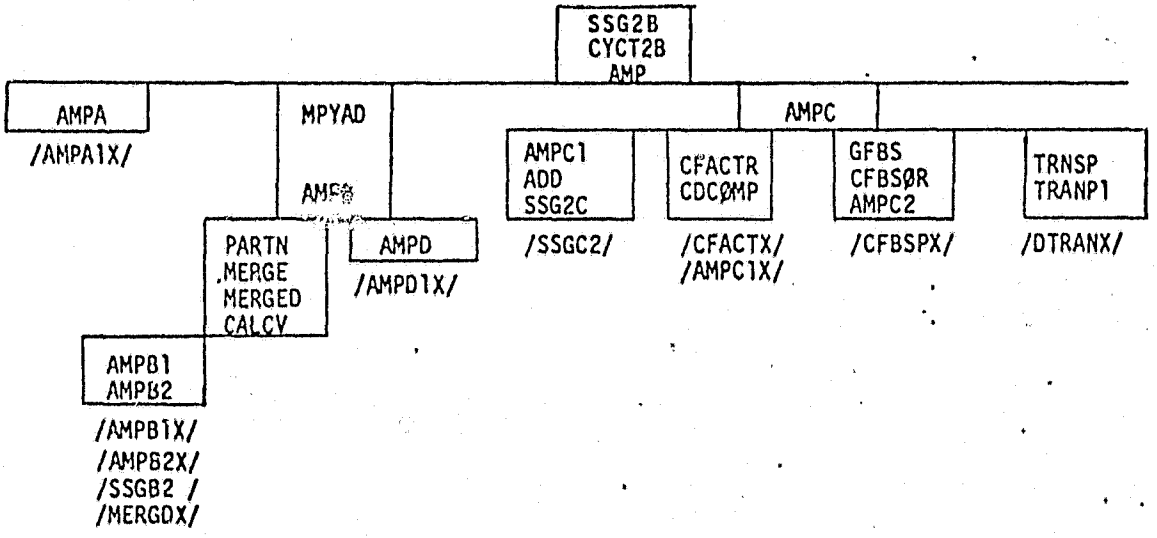
Record No.	Word	Contents
0	1	Header
1	1	M column number
	2	K column number
	3	AJJL column number
	4	QHHLØ column number (0 implies recompute)

Open core AMPA1X is laid out as follows:



2 Buffers

3. Overlay Considerations: To maximize open core, AMP could look as follows:



4.117 FUNCTIONAL MODULE FA2 (FLUTTER ANALYSIS - PHASE 2)

4.117.1 Entry Point: FA2

4.117.2 Purpose

To collect data for reduction and presentation for each loop through the configuration parameters.

4.117.3 DMAP Calling Sequence

```
FA2     PHIH,CLAMA,FSAVE / PHIHL,CLAMAL,CASEYY,ØVG / V,N,TSTART / C,Y,VREF
        *1.0 / C,Y,PRINT=YES $
```

4.117.4 Input Data Blocks

PHIH - Complex eigenvectors - h set, modal formulations.

CLAMA - Complex eigenvalue output table.

FSAVE - Flutter storage save table.

Note: No input data block may be purged.

4.117.5 Output Data Blocks

PHIHL - Appended complex mode shapes - h set.

CLAMAL - Appended complex eigenvalue output table.

CASEYY - Appended case control data table.

ØVG - Output aeroelastic curve requests (V-g or V-f).

Notes:

1. No output data block may be purged.
2. All output data blocks are read (DMAP attribute APPEND) on subsequent calls (FLØØP from FSAVE ≠ 1).

4.117.6 Parameters

TSTART - Integer-input/output-no default value. On input TSTART is the CPU time at the start of the DMAP flutter loop. On output TSTART will be -1 if there is insufficient time for another DMAP loop.

VREF - Real-user input-default = 1.0. V_{out} will be scaled by VREF:

$$V_{out} = V/V_{ref}$$

PRINT - BCD-user input-default = YES. If PRINT = NØ, no flutter summary will be printed.

For YES the wing flutter summary will be printed.

For YESB the blade summary will be printed.

4.117.7 Method

The primary purpose of module FA2 is to gather data for reduction and presentation. The header record of FSAVE will contain the METHØD. Only the k-method is defined. This module is near the end of a DMAP loop. Its output files PHIHL, CLAMAL, CASEYY AND ØVG are appended for each entry. On the first pass, special code must be executed to initiate the files.

The complex eigenvalues λ have been found by module CEAD. These should have been sorted by Im(λ) increasing. Only use the first "NVALUE" modes. The quantitites that need to be computed are:

MACH can be interblade phase angle SIGMA for compressor blade flutter analysis.

$$V_{out} = Im(\lambda)/V_{ref}$$

$$g = \begin{cases} (2.0)\ Re(\lambda)/Im(\lambda) & \text{if } Im(\lambda) \neq 0 \\ 0 & \text{if } Im(\lambda) = 0 \end{cases},$$

$$f = k\ Im(\lambda)/2\pi b_{ref},$$

$$V_{mach} = V_{sound}\ m/V_{ref}.$$

The values of the parameter FLØØP, m, k, b_{ref} and NVALUE are found in the file FSAVE. A printer output is prepared the format is:

FLUTTER SUMMARY (K METHOD)

LØØP	DENRATIØ	KFREQ	1./KFREQ	MACH	MACH*VSOUND	VEL(K)	G(DAMP)	FREQ
I	R	R	R	R	R	R	R	R
FLØØP	ρ	K	1./K	m	$M*V_{sound}$	V_{out}	g	f

The PHIHL, CASEYY and CLAMAL data blocks are created by appending the PHIH, CASEYY and CLAMA data blocks. (Note: Some method of mode selection is expected to be added here. At present, we will rely upon ALLMAT to select vectors.)

The CASEYY data block is for SDR2 and PLØT. It must keep in step with the append vectors. m, k, ρ and FLØØP will be added to the LABEL

The ØVG data block is appended each time through the LØØP. This will be used to create V-g or V-f plots. m, k, ρ and FLØØP will be added to the LABEL.

4.117.8 Subroutines

Utility routine CYCT2B is called.

4.117.9 Design Requirements

Open core for FA2 is at /FA2X/.

4.117.10 Diagnostic Messages

The following messages may occur: 3001, 3002, 3003, 3007, 3008 and 3045. Only 3045 is a user message. It indicates that the DMAP loop was not completed by exhausting the configuration parameters but rather by a time-to-go failure.

RIGID FORMAT RESTART TABLES

Displacement Approach Rigid Formats

Solution Number	Rigid Format Name	Section
1	STATICS	10.2
2	INERTIA RELIEF	10.3
3	MØDES or NØRMAL MØDES or REAL EIGENVALUES	10.4
4	DIFFERENTIAL STIFFNESS	10.5
5	BUCKLING	10.6
6	PIECEWISE LINEAR	10.7
7	DIRECT CØMPLEX EIGENVALUES	10.8
8	DIRECT FREQUENCY RESPØNSE	10.9
9	DIRECT TRANSIENT RESPØNSE	10.10
10	MØDAL CØMPLEX EIGENVALUES	10.11
11	MØDAL FREQUENCY RESPØNSE	10.12
12	MØDAL TRANSIENT RESPØNSE	10.13
13	NØRMAL MØDES ANALYSIS WITH DIFFERENTIAL STIFFNESS	10.14
14	STATICS CYCLIC SYMMETRY	10.15
15	MØDES CYCLIC SYMMETRY	10.16
16	STATIC AERØTHERMØELASTIC ANALYSIS WITH DIFFERENTIAL STIFFNESS	10.21

Heat Transfer Approach Rigid Formats

Solution Number	Rigid Format Name	Section
1	STATICS	10.17
3	STEADY STATE	10.18
9	TRANSIENT	10.19

Aeroelastic Approach Rigid Format

Solution Number	Rigid Format Name	Section
9	COMPRESSOR BLADE CYCLIC MODAL FLUTTER ANALYSIS	10.22
10	MODAL FLUTTER ANALYSIS	10.20

Table 1 Rigid Format Index Table

10.21 RESTART TABLES FOR STATIC AEROELASTIC ANALYSIS

10.21.1 Bit Positions for Card Name Restart Table

Card Name	Bit Pos.
AXIC	1
AXIF	1
CELAS1	1
CELAS2	1
CELAS3	1
CELAS4	1
CMASS1	1
CMASS2	1
CMASS3	1
CMASS4	1
CORD1C	1
CORD1R	1
CORD1S	1
CORD2C	1
CORD2R	1
CORD2S	1
GRDSET	1
GRID	1
GRIDB	1
POINTAX	1
RINGAX	1
RINGFL	1
SECTAX	1
SEQGP	1
SPCINT	1
ADUM1	2
ADUM2	2
ADUM3	2
ADUM4	2
ADUM5	2
ADUM6	2
ADUM7	2
ADUM8	2
ADUM9	2
BAROR	2
CBAR	2
CCONEAX	2
CDUM1	2
CDUM2	2
CDUM3	2
CDUM4	2
CDUM5	2
CDUM6	2
CDUM7	2
CDUM8	2
CDUM9	2
CHEXA1	2
CHEXA2	2
CIHEX1	2
CIHEX2	2
CIHEX3	2
CONROD	2
CQDMEM	2
CQDMEM1	2
CQDMEM2	2
CQDMEM3	2
CQDPLT	2
CQUAD1	2
CQUAD2	2
CQUADTS	2
CROD	2
CSHEAR	2
CTETRA	2
CTORDRG	2
CTRAPAX	2
CTRAPRG	2
CTRBSC	2
CTRIA1	2
CTRIA2	2
CTRIAAX	2
CTRIARG	2
CTRIATS	2
CTRMEM	2
CTRPLT	2
CTUBE	2
CTWIST	2
CWEDGE	2
PBAR	3
PCONEAX	3
PDUM1	3
PDUM2	3
PDUM3	3
PDUM4	3
PDUM5	3
PDUM6	3
PDUM7	3
PDUM8	3
PDUM9	3
PIHEX	3
PQDMEM	3
PQDMEM1	3
PQDMEM2	3
PQDMEM3	3
PQDPLT	3
PQUAD1	3
PQUAD2	3
PQUADTS	3
PROD	3
PSHEAR	3
PTORDRG	3
PTRAPAX	3
PTRBSC	3
PTRIA1	3
PTRIA2	3
PTRIAAX	3
PTRIATS	3
PTRMEM	3
PTRPLT	3
PTUBE	3
PTWIST	3
GENEL	4
CONM1	5
CONM2	5
PELAS	6
PMASS	7
MAT1	8
MAT2	8
MAT3	8
MATT1	8
MATT2	8
MATT3	8
TABLEM1	8
TABLEM2	8
TABLEM3	8
TABLEM4	8
TEMPMT$	8
TEMPMX$	8
AXISYM$	9
CRIGD1	9
CRIGD2	9
MPC	9
MPCADD	9
MPCAX	9
MPC$	9
SPC	10
SPC1	10
SPCADD	10
SPCAX	10
SPC$	10
ASET	11
ASET1	11
OMIT	11
OMIT1	11
OMITAX	11
SUPAX	12
SUPORT	12
TEMP	13
TEMPAX	13
TEMPD	13
TEMPP1	13
TEMPP2	13
TEMPP3	13
TEMPRB	13
WTMASS	14
GRDPNT	15
PLOTEL	16
IRES	17
PLOT$	18
POUT$	19
LOOP$	22
LOOP1$	23
COUPMASS	24
CPBAR	24
CPQDPLT	24
CPQUAD1	24
CPQUAD2	24
CPROD	24
CPTRBSC	24
CPTRIA1	24

Card Name	Bit Pos.
CPTRIA2	24
CPTRPLT	24
CPTUBE	24
CSP$	25
STREAML1	26
DTI	26
APRESS	26
ATEMP	26
SIGN	26
ZORIGN	26
FXCOOR	26
FYCOOR	26
FZCOOR	26
STREAML	27
PGEOM	27
KTOUT	28
DEFORM	59
DEFORM$	59
LOADS	59
RFORCE$	59
SPCD	59
FORCE	60
FORCE1	60
FORCE2	60
FORCEAX	60
LOAD	60
MOMAX	60
MOMENT	60
MOMENT1	60
MOMENT2	60
PLOAD	60
PLOAD1	60
PLOAD2	60
PLOAD3	60
PRESAX	60
SLOAD	60
GRAV	61
RFORCE	61
TEMPLD$	62

10.21.2 Bit Positions for File Name Restart Table

File Name	Bit Pos.
BGPDT	94
CSTM	94
EQEXIN	94
GPDT	94
GPL	94
SIL	94
ECT	95
GPTT	96
SLT	96
EST	97
GEI	97
GPECT	97
GPST	98
KGGX	98
MGG	99
KGG	100
RG	101
USET	101
YS	101
OGPST	102
GM	103
KNN	104
KFF	105
KFS	105
KSS	105
GO	106
KAA	106
KOO	106
LOO	106
LLL	107
PG	108
PL	109
PO	109
PS	109
RULV	110
RUOV	110
ULV	110
UOOV	110

File Name	Bit Pos.
PG1	111
QG	111
UGV	111
OEF1	112
OES1	112
OPG1	112
OQG1	112
OUGV1	112
PUGV1	112
KDDICT	113
KDELM	113
KDGG	113
KDNN	114
KDFF	115
KDFS	115
KDSS	115
KDAA	116
KBLL	117
KBFS	117
KBSS	117
PBL	117
PBS	117
YBS	117
LBLL	118
UBLV	119
RUBLV	119
QBG	120
UBGV	120
OEFB1	121
OESB1	121
OQBG1	121
OUBGV1	121
PUBGV1	121
ELSETS	122
GPSETS	122
PLTPAR	122
PLTSETX	122
KDICT	123
KELM	123
MDICT	123
MELM	123
CASECCA1	124
GEOM3A1	124
SLTA1	125
GPTTA1	125
PGA1	126
CASECCA	127
GEOM3A	127
SLTA	128
GPTTA	128
PGA	129
PG3	130
GEOM3B	131
PGNA	132
AUGV	133
PGI2	134

10.21.3 Card Name Restart Table

DMP Inst.	Bit Position 1	10	20	30	40	50	60
BEGIN	123456789	0123456789	234				90 12
GP1	1						
SAVE	1						
COND	1						
CHKPNT	1						
$SS	6						
GP2	12 45	6					
CHKPNT	12 45	6					
$SS	6						
PARAML		8					
$SS	7						
PARAMR			6				
PURGE		8					
$SS	7						
COND		8					
$SS	7						
PLTSET		8					
$SS	7						
SAVE		8					
$SS	7						
PRTMSG		8					
$SS	7						
PARAM		8					
$SS	7						
PARAM		8					
$SS	7						
COND		8					
$SS	7						
PLOT		8					
$SS	7						
SAVE		8					
$SS	7						
PRTMSG		8					
$SS	7						
LABEL		8					
$SS	7						
CHKPNT		8					
$SS	67						
GP3	12	3					0 1
SAVE	12	3					0 1
PARAM	12	3 5					0 1
CHKPNT	12	3					0 1
$SS	6						
TA1	1234567	3					
SAVE	1234567	3					
COND	12345678	3					
PURGE	1234567	3					
CHKPNT	1234567	3					
$SS	6						
PARAM	1234 6						
EMG	12345678						

DMP Inst.	Bit Position 1 10 20 30 40 50 60
SAVE	12345678
CHKPNT	12345678
$SS	6
COND	1234 6 8
EMA	1234 6 8
CHKPNT	1234 6 8
$SS	6
LABEL	12345 78 4 4
COND	12345 78 4 4
EMA	12345 78 4 4
CHKPNT	12345 78 4 4
$SS	6
LABEL	12345 78 4 4
COND	123 5 78 45 4
$SS	8
COND	123 5 78 45 4
$SS	8
GPWG	123 5 78 45 4
$SS	8
OFP	123 5 78 45 4 1
$SS	8
LABEL	123 5 78 45 4
$SS	8
EQUIV	1234 6 8
CHKPNT	1234 6 8
$SS	6
COND	1234 6 8
SMA3	1234 6 8
CHKPNT	1234 6 8
$SS	6
LABEL	1234 6 8
PARAM	1 901
GP4	1 901 9
SAVE	1 901 9
COND	1 901 9
PURGE	1 901 9
CHKPNT	1234 6 8901 9
$SS	6
COND	1 2
JUMP	1 2
LABEL	1 2
COND	123 6 890
GPSP	123 6 890
SAVE	123 6 890
COND	123 6 890
OFP	123 6 890
LABEL	123 6 890
EQUIV	1234 6 89
CHKPNT	1234 6 89
$SS	6
COND	1234 6 89

DMP Inst.	Bit Position 1 10 20 30 40 50 60
MCE1	1 9
CHKPNT	1 9
$SS	6
MCE2	1234 6 89
CHKPNT	1234 6 89
$SS	6
LABEL	1234 6 89
EQUIV	1234 6 890
CHKPNT	1234 6 890
$SS	6
COND	1234 6 890
SCE1	1234 6 890
CHKPNT	1234 6 890
$SS	6
LABEL	1234 6 890
EQUIV	1234 6 8901
CHKPNT	1234 6 8901
$SS	6
COND	1234 6 8901
SMP1	1234 6 8901
CHKPNT	1234 6 8901
$SS	6
LABEL	1234 6 8901
RBMG2	1234 6 8901
CHKPNT	1234 6 8901
$SS	6
SSG1	123 5678 3 90 12
CHKPNT	123 5678 3 90 12
$SS	6
PARAM	123 5678 3 6 90 12
COND	123 5678 3 6 90 12
ALG	123 5678 3 67 90 12
COND	123 5678 3 6 90 12
PARAM	123 5678 3 6 90 12
COND	123 5678 3 6 90 12
GP3	123 5678 3 6 90 12
CHKPNT	123 5678 3 6 90 12
$SS	6
SSG1	123 5678 3 6 90 12
CHKPNT	123 5678 3 6 90 12
$SS	6
ADD	123 5678 3 6 90 12
LABEL	123 5678 3 6 90 12
EQUIV	123 5678 3 6 90 12
CHKPNT	123 5678 3 6 90 12
$SS	6
EQUIV	123 567890 1 3 6 90 12
CHKPNT	123 567890 1 3 6 90 12
$SS	6
COND	123 567890 1 3 6 90 12
SSG2	123 567890 1 3 6 90 12

DMAP Inst.	Bit Position 1 10 20 30 40 50 60
CHKPNT	123 5678901 3 6 9012
$SS	6
LABEL	123 5678901 3 6 9012
SSG3	1234567890 1 3 6 9012
SAVE	1234567890 1 3 6 9012
CHKPNT	1234567890 1 3 6 9012
$SS	6
COND	1234567890 1 3 7 6 9012
MATGPR	1234567890 1 3 7 6 9012
MATGPR	1234567890 1 3 7 6 9012
LABEL	1234567890 1 3 7 6 9012
SDR1	1234567890 1 3 6 9012
CHKPNT	1234567890 1 3 6 9012
$SS	6
SDR2	9
PARAM	9
OFP	9
SAVE	9
COND	8
$SS	7
PLOT	8
$SS	7
SAVE	8
$SS	7
PRTMSG	8
$SS	7
LABEL	8
$SS	7
TA1	1234567890 1 6 9012
DSMG1	1234567890 1 6 9012
CHKPNT	1234567890 1 6 9012
$SS	6
COND	123 5678 3 6 9012
EQUIV	123 5678 3 6 9012
LABEL	123 5678 3 6 9012
PARAM	1234567890 1 6 9012
PARAM	1234567890 1 6 9012
PARAMR	1234567890 1 6 9012
PARAML	1234567890 1 6 9012
JUMP	1234567890 1 6 9012
LABEL	1234567890 1 6 9012
EQUIV	1234567890 1 6 9012
CHKPNT	1234567890 1 6 9012
$SS	6
PARAM	1234567890 1 6 9012
EQUIV	1234567890 1 6 9012
CHKPNT	1234567890 1 6 9012
$SS	6
COND	1234567890 1 6 9012
MCE2	1234567890 1 6 9012
CHKPNT	1234567890 1 6 9012

DMAP Inst.	Bit Position 1 10 20 30 40 50 60
$SS	6
LABEL	1234567890 1 6 90 12
EQUIV	1234567890 1 6 90 12
CHKPNT	1234567890 1 6 90 12
$SS	6
COND	1234567890 1 6 90 12
SCR1	1234567890 1 6 90 12
CHKPNT	1234567890 1 6 90 12
$SS	6
LABEL	1234567890 1 6 90 12
EQUIV	1234567890 1 6 90 12
CHKPNT	1234567890 1 6 90 12
$SS	6
COND	1234567890 1 6 90 12
SMP2	1234567890 1 6 90 12
CHKPNT	1234567890 1 6 90 12
$SS	6
LABEL	1234567890 1 6 90 12
ADD	1234567890 1 6 90 12
ADD	1234567890 1 6 90 12
ADD	1234567890 1 6 90 12
COND	1234567890 1 6 90 12
MPYAD	1234567890 1 6 90 12
MPYAD	1234567890 1 6 90 12
UMERGE	1234567890 1 6 90 12
EQUIV	1234567890 1 6 90 12
COND	1234567890 1 6 90 12
UMERGE	1234567890 1 6 90 12
LABEL	1234567890 1 6 90 12
ADD	1234567890 1 6 90 12
EQUIV	1234567890 1 6 90 12
LABEL	1234567890 1 6 90 12
ADD	1234567890 1 6 90 12
COPY	1234567890 1 6 90 12
RBMG2	1234567890 1 23 6 90 12
SAVE	1234567890 1 23 6 90 12
CHKPNT	1234567890 1 23 6 90 12
$SS	6
PRTPARM	1234567890 1 23 6 90 12
PRTPARM	1234567890 1 23 6 90 12
JUMP	1234567890 1 23 6 90 12
LABEL	1234567890 1 23 6 90 12
PARAM	1234567890 1 23 6 90 12
COND	1234567890 1 23 6 90 12
ALG	1234567890 1 23 67 90 12
COND	1234567890 1 23 6 90 12
PARAM	1234567890 1 23 6 90 12
PARAM	1234567890 1 23 6 90 12
COND	1234567890 1 23 6 90 12
GP3	1234567890 1 23 6 90 12
SSG1	1234567890 1 23 6 90 12

DMAP Inst.	1 10	20	Bit Position 30	40	50	60
ADD	12345678901		23 6			9012
LABEL	12345678901		23 6			9012
FQUIV	12345678901		23 6			9012
CHKPNT	12345678901		23 6			9012
$SS	6					
SSG2	12345678901		23 6			9012
SSG3	12345678901		23 6			9012
SAVE	12345678901		23 6			9012
CHKPNT	12345678901		23 6			9012
$SS	6					
COND	12345678901	7	23 6			9012
MATGPR	12345678901	7	23 6			9012
LABEL	12345678901	7	23 6			9012
SDR1	12345678901		23 6			9012
CHKPNT	12345678901		23 6			9012
$SS	6					
COND	12345678901		23 6			9012
EQUIV	12345678901		23 6			9012
LABEL	12345678901		23 6			9012
ADD	12345678901		23 6			9012
DSMG1	12345678901		23 6			9012
CHKPNT	12345678901		23 6			9012
$SS	6					
MPYAD	12345678901		23 6			9012
ADD	12345678901		23 6			9012
DSCHK	12345678901		23 6			9012
SAVE	12345678901		23 6			9012
COND	12345678901		23 6			9012
COND	12345678901		23 6			9012
EQUIV	12345678901		23 6			9012
EQUIV	12345678901		23 6			9012
EQUIV	12345678901		23 6			9012
REPT	12345678901		23 6			9012
TABPT	12345678901		23 6			9012
LABEL	12345678901		23 6			9012
ADD	12345678901		23 6			9012
CHKPNT	12345678901		23 6			9012
$SS	6					
EQUIV	12345678901		23 6			9012
CHKPNT	12345678901		23 6			9012
$SS	6					
EQUIV	12345678901		23 6			9012
REPT	12345678901		23 6			9012
TABPT	12345678901		23 6			9012
LABEL	12345678901		23 6			9012
PARAM	12345678901		23 6 8			9012
COND	12345678901		23 6 8			9012
ADD	12345678901		23 6 8			9012
OUTPUT1	12345678901		23 6 8			9012
OUTPUT1	12345678901		23 6 8			9012
LABEL	12345678901		23 6 8			9012

RIGID FORMAT RESTART TABLES

DMAP Inst.	Bit Position 1 10 20 30 40 50 60
CHKPNT	9
$SS	6
ALG	1234567890123 67 9012
SDR2	89
OFP	9
SAVE	9
SDR1	1234567890123 6 9012
GPFDR	1234567890123 6 9012
OFP	1234567890123 6 9012
COND	8
$SS	7
PLOT	8
$SS	7
SAVE	8
$SS	7
PRTMSG	8
$SS	7
LABEL	8
$SS	7
JUMP	1234567890123456789 234 9012
LABEL	1234567890123456789 234 9012
PRTPARM	1234567890123456789 234 9012
LABEL	1234567890123456789 234 9012
PRTPARM	1234567890123456789 234 9012
LABEL	1234567890123456789 234 9012
PRTPARM	1234567890123456789 234 9012
$SS	8
LABEL	1234567890123456789 234 9012
$SS	8
PRTPARM	1234567890123456789 234 9012
LABEL	1234567890123456789 234 9012
END	1234567890123456789 234 9012

10.21.4 Rigid Format Change Restart Table

DMAP Inst.	Bit Position 63	70	80
BEGIN	345	78901234567	345
GP1			
SAVE			
COND			
CHKPNT			
GP2			
CHKPNT			
PARAML			
PARAMR			
PURGE			
COND			
PLTSET			
SAVE			
PRTMSG			
PARAM			
PARAM			
COND			
PLOT			
SAVE			
PRTMSG			
LABEL			
CHKPNT			
GP3			
SAVE			
PARAM	345	78901234567	345
CHKPNT			
TA1			
SAVE			
COND	345	78901234567	345
PURGE			
CHKPNT			
PARAM			
EMG			
SAVE			
CHKPNT			
COND			
EMA			
CHKPNT			
LABEL			
COND			
EMA			
CHKPNT			
LABEL			
COND			
COND			
PWG			
OFP			
LABEL			
EQUIV			
CHKPNT			
COND			

DMAP Inst.	Bit Position 63	70	80
SMA3			
CHKPNT			
LABEL			
PARAM			
GP4			
SAVE			
COND	345	901234567	345
PURGE			
CHKPNT			
COND	345	901234567	345
JUMP	345	901234567	345
LABEL	345	901234567	345
COND			
GPSP			
SAVE			
COND			
OFP			
LABEL			
EQUIV			
CHKPNT			
COND			
MCE1			
CHKPNT			
MCE2			
CHKPNT			
LABEL			
EQUIV			
CHKPNT			
COND			
SCE1			
CHKPNT			
LABEL			
EQUIV			
CHKPNT			
COND			
SMP1			
CHKPNT			
LABEL			
RBMG2			
CHKPNT			
SSG1			
CHKPNT			
PARAM			
COND			
ALG			
COND			
PARAM			
COND			
GP3			
CHKPNT			
SSG1			

DMAP Inst.	Bit Position 63	70	80
CHKPNT			
ADD			
LABEL			
EQUIV			
CHKPNT			
EQUIV			
CHKPNT			
COND			
SSG2			
CHKPNT			
LABEL			
SSG3	4		
SAVE	4		
CHKPNT	4		
COND	45	8901234567	345
MATGPR	45	8901234567	345
MATGPR	45	8901234567	345
LABEL	45	8901234567	345
SDR1			
CHKPNT			
SDR2			
PARAM			
OFP			
SAVE			
COND			
PLOT			
SAVE			
PRTMSG			
LABEL			
TA1			
DSMG1			
CHKPNT			
COND			
EQUIV			
LABEL			
PARAM			
PARAM			
PARAMR			
PARAML			
JUMP			
LABEL			
EQUIV			
CHKPNT			
PARAM			
EQUIV			
CHKPNT			
COND			
MCE2			
CHKPNT			
LABEL			
EQUIV			

DMAP Inst.	Bit Position 63 70 80
CHKPNT	
COND	
SCE1	
CHKPNT	
LABEL	
EQUIV	
CHKPNT	
COND	
SMP2	
CHKPNT	
LABEL	
ADD	
ADD	
ADD	
COND	
MPYAD	
MPYAD	
UMERGE	
EQUIV	
COND	
UMERGE	
LABEL	
ADD	
EQUIV	
LABEL	
ADD	
COPY	
RBMG2	
SAVE	
CHKPNT	
PRTPARM	
PRTPARM	
JUMP	
LABEL	
PARAM	
COND	
ALG	
COND	
PARAM	
PARAM	
COND	
GP3	
SSG1	
ADD	
LABEL	
EQUIV	
CHKPNT	
SSG2	
SSG3	
SAVE	
CHKPNT	

DMAP Inst.	Bit Position 63	70	80
COND			
MATGPR			
LABEL			
SDR1	345	78901234567	345
CHKPNT	345	78901234567	345
COND			
EQUIV			
LABEL			
ADD			
DSMG1			
CHKPNT			
MPYAD			
ADD			
DSCHK			
SAVE			
COND			
COND			
EQUIV			
EQUIV			
EQUIV			
REPT			
TABPT			
LABEL			
ADD			
CHKPNT			
EQUIV			
CHKPNT			
EQUIV			
REPT			
TABPT			
LABEL			
PARAM			
COND			
ADD			
OUTPUT1			
OUTPUT1			
LABEL			
CHKPNT			
ALG			
SDR2			
OFP			
SAVE			
SDR1			
GPFDR			
OFP			
COND			
PLOT			
SAVE			
PRTMSG			
LABEL			
JUMP	345	78901234567	345

DMAP Int.	Bit Position 63	70	80
LABEL	345	78901234567	345
PRTPARM	345	78901234567	345
LABEL	345	78901234567	345
PRTPARM	345	78901234567	345
LABEL	345	78901234567	345
PRTPARM	345	78901234567	345
LABEL	345	78901234567	345
PRTPARM	345	78901234567	345
LABEL	345	78901234567	345
END	345	78901234567	345

10.21.5 File Name Restart Table

DMAP Inst.	Bit Position 94	100	110	120	130	140	150
BEGIN							
GP1	4						
SAVE	4						
COND	4						
CHKPNT	4						
GP2	5						
CHKPNT	5						
PARAML				2			
PARAMR			7				
PURGE				2			
COND				2			
PLTSET				2			
SAVE				2			
PRTMSG				2			
PARAM				2			
PARAM				2			
COND							
PLOT							
SAVE							
PRTMSG							
LABEL							
CHKPNT				2			
GP3	6						
SAVE	6						
PARAM	6	9					
CHKPNT	6						
TA1	7						
SAVE	7						
COND	7	9					
PURGE	7	2					
CHKPNT	7						
PARAM	8						
EMG				3			
SAVE				3			
CHKPNT				3			
COND	8						
EMA	8						
CHKPNT	8						
LABEL	8						
COND	9						
EMA	9						
CHKPNT	9						
LABEL	9						
COND							
COND							
GPWG							
OFP							
LABEL	7	9					
EQUIV	0						
CHKPNT	0						
COND	0						

DMAP Inst.	94	100	Bit Position 110	120	130	140	150
SMA3		0					
CHKPNT		0					
LABEL		0					
PARAM		1					
GP4		1					
SAVE		1					
COND		1					
PURGE		1 3 56	901	5 7			
CHKPNT		1 3 56	901	5 7			
COND							
JUMP							
LABEL							
COND		2					
GPSP		2					
SAVE		2					
COND		2					
DEP		2					
LABEL		2					
EQUIV		4					
CHKPNT		4					
COND		34					
MCE1		3					
CHKPNT		3					
MCE2		4					
CHKPNT		4					
LABEL		34					
EQUIV		5					
CHKPNT		5					
COND		5					
SCE1		5					
CHKPNT		5					
LABEL		5					
EQUIV		6					
CHKPNT		6					
COND		6					
SMP1		6					
CHKPNT		6					
LABEL		6					
PRMG2		7					
CHKPNT		7					
SSG1					2		
CHKPNT					2		
PARAM				4			
COND				4			
ALG				4			
COND							
PARAM				5			
COND				5			
GP3				5			
CHKPNT				5			
SSG1				6			

DMAP Inst.	94	100	Bit Position 110	120	130	140	150
CHKPNT					6		
ADD			8				
LABEL			8				
EQUIV			8				
CHKPNT			8				
EQUIV			9				
CHKPNT			9				
COND			9				
SSG2			9				
CHKPNT			9				
LABEL			9				
SSG3			0				
SAVE			0				
CHKPNT			0				
COND							
MATGPR							
MATGPR							
LABEL							
SDR1			1				
CHKPNT			1				
SDR2			2				
PARAM							
OFP							
SAVE							
COND							
PLOT							
SAVE							
PRTMSG							
LABEL							
TA1			3				
DSMG1			3				
CHKPNT			3				
COND							
EQUIV							
LABEL							
PARAM							
PARAM							
PARAMR							
PARAML							
JUMP							
LABEL							
EQUIV			4				
CHKPNT			4				
PARAM			4				
EQUIV			4				
CHKPNT			4				
COND			4				
MCE2			4				
CHKPNT			4				
LABEL			4				
EQUIV			5				

DMAP Inst.	Bit Position 94	100	110	120	130	140	150
CHKPNT			5				
COND			5				
SCE1			5				
CHKPNT			5				
LABEL			5				
EQUIV			6				
CHKPNT			6				
COND			6				
SMP2			6				
CHKPNT			6				
LABEL			6				
ADD			7				
ADD			7				
ADD			7				
COND							
MPYAD							
MPYAD							
UMERGE							
EQUIV							
COND							
UMERGE							
LABEL							
ADD							
EQUIV							
LABEL							
ADD							
COPY					3		
RBMG2			8				
SAVE			8				
CHKPNT			8				
PRTPARM			8				
PRTPARM			8				
JUMP							
LABEL							
PARAM							
COND					7		
ALG					7		
COND							
PARAM							
PARAM							
COND					890		
GP3					8		
SSG1					9		
ADD					0		
LABEL							
EQUIV							
CHKPNT					0		
SSG2							
SSG3			9				
SAVE							
CHKPNT							

DMAP Inst.	Bit Position 94	100	110	120	130	140	150
COND							
MATGPR							
LABEL					0		
SDR1					0		
CHKPNT							
COND							
EQUIV							
LABEL							
ADD							
DSMG1							
CHKPNT							
MPYAD							
ADD							
DSCHK							
SAVE							
COND							
COND							
EQUIV							
EQUIV							
EQUIV							
REPT							
TABPT							
LABEL							
ADD							
CHKPNT							
EQUIV							
CHKPNT							
EQUIV							
REPT							
TABPT							
LABEL							
PARAM							
COND							
ADD							
OUTPUT1							
OUTPUT1							
LABEL							
CHKPNT							
ALG						1	
SDR2				1			
OFP							
SAVE							
SDR1							
GPFDR							
OFP							
COND							
PLOT							
SAVE							
PRTMSG							
LABEL							
JUMP							

DMAP Inst.	Bit Position 94	100	110	120	130	140	150
LABEL							
PRTPARM							
LABEL							
PRTPARM							
LABEL							
PRTPARM							
LABEL							
PRTPARM							
LABEL							
END							

10.22 RESTART TABLES FOR COMPRESSOR BLADE CYCLIC MODAL FLUTTER ANALYSIS

10.22.1 Bit Positions for Card Name Restart Table

Card Name	Bit Pos.
ADUM1	1
ADUM2	1
ADUM3	1
ADUM4	1
ADUM5	1
ADUM6	1
ADUM7	1
ADUM8	1
ADUM9	1
AXIC	1
AXIF	1
CELAS1	1
CELAS2	1
CELAS3	1
CELAS4	1
CMASS1	1
CMASS2	1
CMASS3	1
CMASS4	1
CORD1C	1
CORD1R	1
CORD1S	1
CORD2C	1
CORD2R	1
CORD2S	1
GRDSET	1
GRID	1
GRIDB	1
POINTAX	1
RINGAX	1
RINGFL	1
SECTAX	1
SEQGP	1
SPOINT	1
BAROR	2
CBAR	2
CCONEAX	2
CDUM1	2
CDUM2	2
CDUM3	2
CDUM4	2
CDUM5	2
CDUM6	2
CDUM7	2
CDUM8	2
CDUM9	2
CFLUID2	2
CFLUID3	2
CFLUID4	2
CHEXA1	2
CHEXA2	2
CIHEX1	2
CIHEX2	2
CIHEX3	2
CONROD	2
CQDMEM	2
CQDPLT	2
CQUAD1	2
CQUAD2	2
CQUADTS	2
CROD	2
CSHEAR	2
CTETRA	2
CTORDRG	2
CTRAPAX	2
CTRAPRG	2
CTRBSC	2
CTRIA1	2
CTRIA2	2
CTRIAAX	2
CTRIARG	2
CTRIATS	2
CTRMEM	2
CTRPLT	2
CTUBE	2
CTWIST	2
CWEDGE	2
PBAR	3
PCONEAX	3
PDUM1	3
PDUM2	3
PDUM3	3
PDUM4	3
PDUM5	3
PDUM6	3
PDUM7	3
PDUM8	3
PDUM9	3
PIHEX	3
PQDMEM	3
PQDPLT	3
PQUAD1	3
PQUAD2	3
PQUADTS	3
PROD	3
PSHEAR	3
PTORDRG	3
PTRAPAX	3
PTRBSC	3
PTRIA1	3
PTRIA2	3
PTRIAAX	3
PTRIATS	3
PTRMEM	3
PTRPLT	3
PTUBE	3
PTWIST	3
GENEL	4
CONM1	5
CONM2	5
PELAS	6
PMASS	7
MAT1	8
MAT2	8
MAT3	8
MATT1	8
MATT2	8
MATT3	8
TABLEM1	8
TABLEM2	8
TABLEM3	8
TABLEM4	8
TEMPMT$	8
TEMPMX$	8
AXISYM	9
CRIGD1	9
CRIGD2	9
MPC	9
MPCADD	9
MPC$	9
MPCAX	9
SPC	10
SPC1	10
SPCADD	10
SPCAX	10
SPC$	10
ASET	11
ASET1	11
OMIT	11
OMIT1	11
OMITAX	11
SUPAX	12
SUPORT	12
TEMP	13
TEMPAX	13
TEMPD	13
TEMPP1	13
TEMPP2	13
TEMPP3	13
TEMPRB	13
GRDPNT	15
PLOTEL	16
PLOT$	18
POUT$	19
XYOUT$	20
AOUT$	21
COUPMASS	24
CPBAR	24
CPDPLT	24
CPQUAD1	24
CPQUAD2	24
CPROD	24
CPTRBSC	24
CPTRIA1	24
CPTRIA2	24
CPTRPLT	24
CPTUBE	24
MTMASS	24
NODJE	26
PAERO1	29

Card Name	Bit Pos.
SET1	32
SET2	32
SPLINE1	32
SPLINE2	32
MKAERO1	34
MKAERO2	34
AEFACT	35
FLFACT	36
FLUTTER	36
AERO	37
CAERO1	37
FMETHOD$	38
VREF	39
TF	40
CYJOIN	41
CTYPE	41
NSEGS	41
KINDEX	41
CYCSEQ	42
STREAML1	42
STREAML2	42
IREF	42
MINMACH	42
MAXMACH	42
MTYPE	42
KGGIN	43
SDAMP$	55
TABDMP1	55
EPOINT	56
SEQEP	56
B2PP$	57
DMIG	57
K2PP$	57
M2PP$	57
TF$	57
EIGR	58
METHOD$	59
EIGC	60
EIGP	60
CMETHOD$	61
HFREQ	62
LFREQ	62
LMODES	62

10.22.2 Bit Positions for File Name Restart Table

File Name	Bit Pos.	File Name	Bit Pos.
BGPDT	94	KELM	121
CSTM	94	MDICT	121
EQEXIN	94	MELM	122
GPDT	94	MAA	123
GPL	94	ACPT	124
SIL	94	AERO	124
ECT	95	BGPA	124
GPTT	96	CSTMA	124
EST	97	ECTA	124
GEI	97	EQAERO	124
GPECT	97	FLIST	124
GPST	98	GPLA	124
KGGX	98	SILA	124
MGG	99	SILGA	124
KGG	100	SPLINE	124
RG	101	USETA	124
USET	101	ELSETSA	125
OGPST	102	GPSETSA	125
GM	103	PLTPARA	125
KNN	104	PLTSETA	125
MNN	104	GTKA	126
KFF	105	AJJL	127
KFS	105	D1JK	127
MFF	105	D2JK	127
KAA	106	SKJ	127
KLL	107	D1JE	128
KLR	107	D2JE	128
KRR	107	BXHH	129
MLL	107	KXHH	129
MLR	107	MXHH	129
MRR	107	FSAVE	129
LLL	108	CASEYY	130
DM	109	CLAMAL	130
MR	110	OVG	130
EED	111	PHIHL	130
EQDYN	111	CLAMAL1	131
GPLD	111	CPHIH1	131
SILD	111	CPHIA	132
TFPOOL	111	RP	132
USETD	111	CPHIK	133
LAMA	112	CPHIPS	134
MI	112	CPHIPA	136
OEIGS	112	QPAC	136
PHIA	112	OCPHIPA	137
GO	113	OEFC1	137
B2PP	114	OESC1	137
K2PP	114	OQPAC1	137
M2PP	114	PCPHIPA	137
GMD	115	QHHL	138
GOD	115	QJHL	138
BHH	116	B2DD	139
KHH	116	K2DD	139
MHH	116	M2DD	139
PHIDH	116	CYCD	140
CLAMA	117	KKK	141
OCEIGS	117	MKK	141
PHIH	117	PHIK	142
CPHID	118	LAMK	142
CPHIP	120	PHIG	143
QPC	120	PVECT	144
KDICT	122	PHIAX	145

10.22.3 Card Name Restart Table

DMAP Inst.	Bit Position 1 10 20 30 40 50 60
BEGIN	1234567890123456 8901234 6 9 2 4567890 567890 12
FILE	1234567890123 4 9 1234 6 9 2 4567890 567890 12
GP1	1
SAVE	1
COND	1
CHKPNT	1
$SS	6
PURGE	6 7
GP2	12 45 6
CHKPNT	12 45 6
$SS	6
GP3	12 3
CHKPNT	12 3
$SS	6
TA1	1234567 3
SAVE	1234567 3
COND	1234567 34
PURGE	1234567
CHKPNT	1234567 3
$SS	6
PARAM	123 6 8 3
PARAM	123 5 78 34 4
PARAM	3
COND	3
PARAM	3
INPUTT1	3
EQUIV	3
CHKPNT	3
$SS	6
LABEL	3
EMG	123 5678 34 4 3
SAVE	123 5678 34 4 3
CHKPNT	123 5678 34 4 3
$SS	6
COND	123 6 8 3 3
EMA	123 6 8 3 3
CHKPNT	123 6 8 3 3
$SS	6
LABEL	123 6 8 3 3
COND	123 5 78 34 4
EMA	123 5 78 34 4
CHKPNT	123 5 78 34 4
$SS	6
COND	123 5 78 345 4
GPWG	123 5 78 345 4
OFP	123 5 78 345 4
LABEL	123 5 78 345 4
EQUIV	1234 6 8 3 3
CHKPNT	1234 6 8 3 3
$SS	6
COND	1234 6 8 3 3

COMPRESSION BLADE CYCLIC MODAL FLUTTER ANALYSES

DMAP Inst.	Bit Position 1 10 20 30 40 50 60
SMA3	1234 6 8 3 3
CHKPNT	1234 6 8 3 3
$SS	6
LABEL	1234 6 8 3 3
GP4	1 9012
SAVE	1 9012
PARAM	1 9012 3
COND	1 9012 3
PURGE	1 9012 3
GPCYC	1 901 1
SAVE	1 901 1
CHKPNT	1 901 1
$SS	6
COND	1 901 1
COND	1234 6 890 3 3
GP$P	1234 6 890 3 3
SAVE	1234 6 890 3 3
COND	1234 6 890 3 3
OFP	1234 6 890 3 3
LABEL	1234 6 890 3 3
EQUIV	123456789 4 4 3
CHKPNT	123456789 4 4 3
$SS	6
COND	123456789 34 4 3
MCE1	1 9 3 3
CHKPNT	1 9 3 3
$SS	6
MCE2	123456789 34 4 3
CHKPNT	123456789 34 4 3
$SS	6
LABEL	123456789 34 4 3
EQUIV	1234567890 34 4 3
CHKPNT	1234567890 34 4 3
$SS	6
COND	1234567890 34 4 3
SCE1	1234567890 34 4 3
CHKPNT	1234567890 34 4 3
$SS	6
LABEL	1234567890 34 4 3
EQUIV	12345678901 34 4 3
CHKPNT	12345678901 34 4 3
$SS	6
COND	12345678901 34 4 3
SMP1	1234 6 8901 3 3
CHKPNT	1234 6 8901 3 3
$SS	6
SMP2	12345678901 34 4
CHKPNT	12345678901 34 4
$SS	6
LABEL	12345678901 34 4
DPD	1 9012 0 6 8 0

DMAP Inst.	Bit Position 1 10 20 30 40 50 60
SAVE	1 9 12 0 6 8 0
COND	1 9 12 0 6 8 0
EQUIV	1234567 9 12 4 234 6 8
CYCT2	12345678901 1 3 8
SAVE	12345678901 1 3 8
CHKPNT	12345678901 1 3 8
$SS	6
COND	12345678901 1 3
READ	12345678901234 4 1 3 89
SAVE	12345678901234 4 1 3 89
CHKPNT	12345678901234 4 1 3 89
$SS	6
PARAM	12345678901234 4 1 3 89
OFP	12345678901234 4 1 3 89
SAVE	12345678901234 4 1 3 89
COND	12345678901234 4 1 3 89
CYCT2	12345678901 4 1 3 89
SAVE	12345678901 4 1 3 89
CHKPNT	12345678901 4 1 3 89
$SS	6
COND	12345678901 4 1 3 89
SDR1	12345678901 4 1 3 89
SDR2	89
OFP	9
SAVE	9
APDR	12 9 12 4567 123
SAVE	12 9 12 4567 123
CHKPNT	12 9 12 4567 123
$SS	6
PARTN	12 9 12 4567 123
SMPYAD	12 9 12 4567 123
MTRXIN	1 23 0 67
SAVE	1 23 0 67
PURGE	12 4 23 0 67
EQUIV	12 4 9 1 23 0 67
CHKPNT	12 4 9 1 23 0 67
$SS	6
GKAD	1234 6 8901 34 23 0123 67
CHKPNT	1234 6 8901 34 23 0123 67
$SS	6
GKAM	12345678901234 234 0123 56789 2
SAVE	12345678901234 234 0123 56789 2
CHKPNT	12345678901234 234 0123 56789 2
$SS	6
PARAML	8
$SS	7
PURGE	8
$SS	7
COND	8
$SS	7
PLTSET	8

COMPRESSOR BLADE CYCLIC MODAL FLUTTER ANALYSIS

```
DAMP                          Bit Position
Inst.     1        10        20        30        40        50        60
$SS             7
SAVE                     8
$SS             7
PRTMSG                   8
$SS             7
PARAM                    8 0
$SS             7
PARAM                    8
$SS             7
COND                     8
$SS             7
PLOT                     8
$SS             7
SAVE                     8
$SS             7
PRTMSG                   8
$SS             7
LABEL                    8
$SS             7
COND      1       9012                           0               6 8 0
PARAM     1                           9     5 7
AMG       1                           9    45 7    23
SAVE      1                           9    45 7    23
CHKPNT    1                           9    45 7    23
$SS            6
COND                                6          7
INPUTT2                             6          7
LABEL                               6          7
PARAM     1234567890123          4 6  9  2  5 7   123            6 89  2
AMP       1234567890123          4 6  9  2  5 7   123            6 89  2
SAVE      1234567890123          4 6  9  2  5 7   123            6 89  2
CHKPNT    1234567890123          4 6  9  2  5 7   123            6 89  2
$SS            6
PARAM                      0
PARAM                    8
PARAM                       1
PARAM     1234567890123          4 6  9  2 4567890              56789012
JUMP      1234567890123          4 6  9  2 4567890              56789012
LABEL     1234567890123          4 6  9  2 4567890              56789012
FAI       1234567890123          4 6  9  2 4567890123           56789012
SAVE      1234567890123          4 6  9  2 4567890123           56789012
CFAD      1234567890123          4 6  9  2 4567890123           56789012
SAVE      1234567890123          4 6  9  2 4567890123           56789012
COND      1234567890123          4 6  9  2 4567890123           56789012
COND                        1
VDR                         1
SAVE                        1
COND                        1
OFP                         1
SAVE                        1
LABEL                       1
```

DMAP Inst.	Bit Position 1 10 20 30 40 50 60
FA2	1234567890123 4 6 9 2 4567890123 567890 12
SAVE	1234567890123 4 6 9 2 4567890123 567890 12
CHKPNT	1234567890123 4 6 9 2 4567890123 567890 12
$SS	6
COND	1234567890123 4 6 9 2 4567890123 567890 12
LABEL	1234567890123 4 6 9 2 4567890123 567890 12
COND	1234567890123 4 6 9 2 4567890123 567890 12
REPT	1234567890123 4 6 9 2 4567890123 567890 12
JUMP	1234567890123 4 6 9 2 4567890123 567890 12
LABEL	1234567890123 4 6 9 2 4567890123 567890 12
CHKPNT	1234567890123 4 6 9 2 4567890123 567890 12
$SS	6
PARAML	0
COND	0
XYTRAN	0
SAVE	0
XYPLOT	0
LABEL	0
PARAM	1 1234567890123 4 6 9 2 4567890123 567890 12
COND	1 1234567890123 4 6 9 2 4567890123 567890 12
MODACC	1234567890123 4 6 9 2 4567890123 567890 12
DDR1	1234567890123 4 6 9 2 4 67890123 567890 12
CHKPNT	1234567890123 4 6 9 2 4 67890123 567890 12
$SS	6
EQUIV	1234567890123 4 6 9 2 4567890123 567890 12
COND	1234567890123 4 6 9 2 4567890123 567890 12
SDR1	1234567890123 4 6 9 2 4567890123 567890 12
LABEL	1234567890123 4 6 9 2 4567890123 567890 12
CHKPNT	1234567890123 4 6 9 2 4567890123 567890 12
$SS	6
EQUIV	1234567890123 4 6 9 2 4567890123 567890 12
COND	1234567890123 4 6 9 2 4567890123 567890 12
VEC	1234567890123 4 6 9 2 4567890123 567890 12
PARTN	1234567890123 4 6 9 2 4567890123 567890 12
LABEL	1234567890123 4 6 9 2 4567890123 567890 12
SDR2	1234567890123 4 6 9 2 4567890123 567890 12
CHKPNT	1234567890123 4 6 9 2 4567890123 567890 12
$SS	6
OFP	9
COND	8
$SS	7
PLOT	8
$SS	7
PRTMSG	8
$SS	7
LABEL	8
$SS	7
JUMP	1234567890123456890 1234 6 9 2 4567890123 567890 12
LABEL	1234567890123456890 1234 6 9 2 4567890123 567890 12
PRTPARM	1234567890123456890 1234 6 9 2 4567890123 567890 12
LABEL	1234567890123456890 1234 6 9 2 4567890123 567890 12

COMPRESSOR BLADE CYCLIC MODAL FLUTTER ANALYSIS

DMAP Inst.	Bit Position						
	1 10	20	30	40	50	60	
PRTPARM	1234567890	123456 890	1234 6 9	2 4567890	123	567890	12
LABEL	1234567890	123456 890	1234 6 9	2 4567890	123	567890	12
PRTPARM	1234567890	123456 890	1234 6 9	2 4567890	123	567890	12
LABEL	1234567890	123456 890	1234 6 9	2 4567890	123	567890	12
PRTPARM	1234567890	123456 890	1234 6 9	2 4567890	123	567890	12
LABEL	1234567890	123456 890	1234 6 9	2 4567890	123	567890	12
PRTPARM	1234567890	123456 890	1234 6 9	2 4567890	123	567890	12
LABEL	1234567890	123456 890	1234 6 9	2 4567890	123	567890	12
PRTPARM	1234567890	123456 890	1234 6 9	2 4567890	123	567890	12
LABEL	1234567890	123456 890	1234 6 9	2 4567890	123	567890	12
END	1234567890	123456 890	1234 6 9	2 4567890	123	567890	12

10.22.4 Rigid Format Change Restart Table

DMAP Inst.	Bit Position 63 70 80
BEGIN	345678901234567 345
FILE	345678901234567 345
GP1	
SAVE	
COND	345678901234567 345
CHKPNT	
PURGE	
GP2	
CHKPNT	
GP3	
CHKPNT	
TA1	
SAVE	
COND	345678901234567 345
PURGE	
CHKPNT	
PARAM	
PARAM	3 678
PARAM	
COND	
PARAM	
INPUTT1	
EQUIV	
CHKPNT	
LABEL	
EMG	3 678
SAVE	3 678
CHKPNT	3 678
COND	
EMA	
CHKPNT	
LABEL	
COND	3 678
EMA	3 678
CHKPNT	3 678
COND	
GPWG	
OFP	
LABEL	
EQUIV	
CHKPNT	
COND	
SMA3	
CHKPNT	
LABEL	
GP4	
SAVE	
PARAM	
COND	
PURGE	
GPCYC	

COMPRESSOR BLADE CYCLIC MODAL FLUTTER ANALYSIS

DMAP Inst.	Bit Position 63	70	80
SAVE			
CHKPNT			
COND			
COND			
GPSP			
SAVE			
COND			
OFP			
LABEL			
EQUIV			
CHKPNT			
COND			
MCE1			
CHKPNT			
MCE2			
CHKPNT			
LABEL			
EQUIV			
CHKPNT			
COND			
SCE1			
CHKPNT			
LABEL			
EQUIV			
CHKPNT			
COND			
SMP1			
CHKPNT			
SMP2			
CHKPNT			
LABEL			
DPD			
SAVE			
COND	345678901234567		345
EQUIV			
CYCT2			
SAVE			
CHKPNT			
COND			
READ			
SAVE			
CHKPNT			
PARAM			
OFP			
SAVE			
COND	345678901234567		345
CYCT2			
SAVE			
CHKPNT			
COND			
SOR1			

DMAP Inst.	Bit Position 63	70	80
SDR2			
OFP			
SAVE			
APDB			
SAVE			
CHKPNT			
PARTN			
SMPYAD			
MTRXIN			
SAVE			
PURGE			
EQUIV			
CHKPNT			
GKAD			
CHKPNT			
GKAM	3	234	
SAVE	3	234	
CHKPNT	3	234	
PARAML			
PURGE			
COND			
PLTSET			
SAVE			
PRTMSG			
PARAM			
PARAM			
COND			
PLOT			
SAVE			
PRTMSG			
LABEL			
COND			
PARAM	345678901234567		345
AMG			
SAVE			
CHKPNT			
COND			
INPUTT2			
LABEL			
PARAM			
AMP			
SAVE			
CHKPNT			
PARAM			
PARAM			
PARAM	345678901234567		345
PARAM	345678901234567		345
JUMP	345678901234567		345
LABEL	345678901234567		345
FA1			
SAVE			

DMAP Inst.	Bit Position 63	70	80
CEAD			
SAVE			
COND			
COND			
VDR			
SAVE			
COND			
OFP			
SAVE			
LABEL			
FA2			
SAVE			
CHKPNT			
COND	345678901234567		345
LABEL	345678901234567		345
COND	345678901234567		345
REPT	345678901234567		345
JUMP	345678901234567		345
LABEL	345678901234567		345
CHKPNT	345678901234567		345
PARAML			
COND			
XYTRAN			
SAVE			
XYPLOT			
LABEL			
PARAM			
COND			
MODACC			
DDR1			
CHKPNT			
EQUIV			
COND			
SDR1			
LABEL			
CHKPNT			
EQUIV			
COND			
VEC			
PARTN			
LABEL			
SDR2			
CHKPNT			
OFP			
COND			
PLOT			
PRTMSG			
LABEL			
JUMP	345678901234567		345
LABEL	345678901234567		345
PRTPARM	345678901234567		345

DMAP Inst.	Bit Position 63	70	80
LABEL	345678901234567		345
PRTPARM	345678901234567		345
LABEL	345678901234567		345
PRTPARM	345678901234567		345
LABEL	345678901234567		345
PRTPARM	345678901234567		345
LABEL	345678901234567		345
PRTPARM	345678901234567		345
LABEL	345678901234567		345
PRTPARM	345678901234567		345
LABEL	345678901234567		345
END	345678901234567		345

10.22.5 File Name Restart Table

DMAP Inst.	94	100	Bit Position 110	120	130	140	150
BEGIN							
FILE							
GP1	4						
SAVE	4						
COND	4						
CHKPNT	4						
PURGE					8		
GP2	5						
CHKPNT	5						
GP3	6						
CHKPNT	6						
TA1	7						
SAVE	7						
COND	7						
PURGE	7	2					
CHKPNT	7	2					
PARAM	8						
PARAM	9						
PARAM	8						
COND	8						
PARAM	8						
INPUTT1	8						
EQUIV	8						
CHKPNT	8						
LABEL							
EMG				2			
SAVE				2			
CHKPNT				2			
COND	8						
EMA	8						
CHKPNT	8						
LABEL	8						
COND	9						
EMA	9						
CHKPNT	9						
COND							
GPWG							
OFP							
LABEL							
EQUIV	0						
CHKPNT	0						
COND	0						
SMA3	0						
CHKPNT	0						
LABEL	0						
GP4	1						
SAVE	1						
PARAM	1						
COND							
PURGE		3	5	0			
GPCYC						0	

DMAP Inst.	Bit Position 94	100	110	120	130	140	150
SAVE						0	
CHKPNT						0	
COND						0	
COND		2					
GPSP		2					
SAVE		2					
COND		2					
OFP		2					
LABEL		2					
EQUIV		4					
CHKPNT		4					
COND		34					
MCE1		3					
CHKPNT		3					
MCE2		4					
CHKPNT		4					
LABEL		34					
EQUIV		5					
CHKPNT		5					
COND		5					
SCE1		5					
CHKPNT		5					
LABEL		5					
EQUIV		6		3			
CHKPNT		6		3			
COND		6	3	3			
SMP1		6	3				
CHKPNT		6	3				
SMP2				3			
CHKPNT				3			
LABEL		6	3	3			
DPD			1				
SAVE			1				
COND			1				
EQUIV			5				
CYCT2						1	
SAVE						1	
CHKPNT						1	
COND						1	
READ			2			2	
SAVE			2			2	
CHKPNT			2			2	
PARAM			2			2	
OFP			2			2	
SAVE			2			2	
COND			2			2	
CYCT2			2				
SAVE			2				
CHKPNT			2				
COND			2				
SDR1			3				

DMAP Inst.	94	100	Bit Position 110	120	130	140	150
SDR2							
OFP							
SAVE							
APDB				4 6		4	
SAVE				4 6		4	
CHKPNT				4 6		4	
PARTN						5	
SMPYAD			2				
MTRXIN			4				
SAVE			4		9		
PURGE			4		9		
EQUIV			4		9		
CHKPNT			4		9		
GKAD			5		9		
CHKPNT			5		9		
GKAM			6				
SAVE			6				
CHKPNT			6				
PARAML				5			
PURGE				4			
COND				5			
PLTSET				5			
SAVE				5			
PRTMSG				5			
PARAM				5			
PARAM				5			
COND				5			
PLOT				5			
SAVE							
PRTMSG							
LABEL				5			
COND							
PARAM							
AMG				7			
SAVE				7			
CHKPNT				7			
COND				8			
INPUTT2				8			
LABEL				8			
PARAM					8		
AMP					8		
SAVE					8		
CHKPNT					8		
PARAM							
PARAM							
PARAM							
PARAM							
JUMP							
LABEL							
FA1					9		
SAVE					9		

DMAP Inst.	Bit Position 94	100	110	120	130	140	150
CEAD					7		
SAVE					7		
COND					7		
COND							
VDR							
SAVE							
COND							
OFP							
SAVE							
LABEL							
FA2				0			
SAVE				0			
CHKPNT				0			
COND							
LABEL							
COND							
REPT							
JUMP							
LABEL							
CHKPNT							
PARAML							
COND							
XYTRAN							
SAVE							
XYPLOT							
LABEL							
PARAM							
COND							
MODACC					1		
DDR1			8				
CHKPNT			8				
EQUIV				0			
COND				0			
SDR1				0			
LABEL				0			
CHKPNT				0			
EQUIV				2			
COND				2			
VEC					2		
PARTN					2		
LABEL					2		
SDR2						7	
CHKPNT						7	
OFP							
COND							
PLOT							
PRTMSG							
LABEL							
JUMP							
LABEL							
PRTPARM							

COMPRESSOR BLADE CYCLIC MODAL FLUTTER ANALYSIS

DMAP Inst.	94	100	Bit Position 110	120	130	140	150
LABEL							
PRTPARM							
LABEL							
PRTPARM							
LABEL							
PRTPARM							
LABEL							
PRTPARM							
LABEL							
PRTPARM							
LABEL							
END							